MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2017/2018

BMF1014 – MATHEMATICS FOR FINANCE

(All sections / Groups)

05 JUNE 2018
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 5 pages excluding the cover page.
2. Attempt ALL FOUR questions.
3. Write your answers in the Answer Booklet provided.
4. Mathematical formula is attached at the end of this question paper.

Question 1 (25 marks)

(a) Suppose we have two straight lines, L1 and L2.

(i) Find an equation of L1 that passes through the points (2, 4) and (3,0).

[5 marks]

(ii) Find an equation of L2 that passes through the points (3, 4) and (7, 5).

[5 marks]

(iii) Determine whether LI and L2 are parallel, perpendicular or neither.

[2 marks]

(b) If the demand function for a commodity is given by the equation

$$p(q) = -q + 40$$

and the supply function for a commodity is given by the equation

$$p(q) = 3q + 20$$

where p is the price of the product and q is the quantity. Find the equilibrium quantity and equilibrium price.

[6 marks]

(c) The total costs for a company are given by $C(x) = 20x + 7400$ and the total revenues are given by $R(x) = 45x$ where x is the number of units produced daily.

(i) Find the profit function.

[3 marks]

(ii) Find the number of units that gives break-even.

[4 marks]

Question 2 (25 marks)

Consider the following system of equations

$$\begin{aligned} 2x + 4y + z &= 10 \\ x + 3y + 2z &= 4 \\ 4x + y + z &= 8 \end{aligned}$$

(a) Write the system of equation above in a form $\boldsymbol{Ax = B}$.

[3 marks]

Continued...

(b) Find the determinant, minor and the inverse of matrix A.

[17 marks]

(c) Find value of x, y and z.

[5 marks]

Question 3 (25 marks)

(a) Find the accumulated amount if RM5200 is invested for 10 years at 8%.

[4 marks]

(b) A family is planning to buy an apartment costing \$150,000. They must pay 30% down payment and the rest is to be amortized over 30 years in equal monthly payments. If the money costs 9% compounded monthly,

(i) What will their monthly payment be?

[8 marks]

(ii) How much total interest will be paid over the 30 years?

[4 marks]

(c) A bank account pay 6% interest compounded quarterly. How much must be deposited now so that the account contains \$240,000 at the end of 3.5 years?

[5 marks]

(d) Find the effective rate of interest corresponding to a nominal rate of 6.3% per year compounded

(i) annually

[2 marks]

(ii) monthly.

[2 marks]

Question 4 (25 marks)

(a) Find the derivatives of the following functions using the appropriate techniques.

(i) $y=\left(4x^3-21x^2+8\right)\left(3x+1\right)$

[6 marks]

(ii) $y=\sqrt{4x^4-2x^3+16x-2}$

[5 marks]

Continued...

(b) The monthly profit (in dollars) of Joe Department Store depends on the level of inventory x (in thousands of dollars) and the floor space y (in thousands of square feet) available for display of the merchandise as given by the equation

$$P(x,y) = -0.03x^2 - 24y^2 + 3xy - 35x + 25y - 30,000.$$

Compute $\frac{\partial P}{\partial x}$ and $\frac{\partial P}{\partial y}$ when $x = 2000$ and $y = 300$.

[8 marks]

(c) Consider the expression: $2x\left(4x^2+8\right)^3$.

(i) If $u = 4x^2 + 8$, find $\frac{du}{dx}$.

[2 marks]

(ii) Evaluate $\int 2x\left(4x^2+8\right)^3 dx$ using substitution method.

[4 marks]

End of Question Page.

Subject Code: BMF1014
Subject Name: Mathematics for Finance

Summary of Principal Formulas and Terms

1. Quadratic Formula

The solution of the equation: $ax^2 + bx + c = 0$ where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2. Simple Interest

(i) Interest, $I = Prt$ (P = principal, r = interest rate, t = number of years)

(ii) Accumulated amount, $A = P(1 + rt)$

3. Compound Interest

(i) Accumulated amount, $A = P(1+i)^n$, where $i = \frac{r}{m}$, and $n = mt$

(m = number of conversion periods per year)

(ii) Present value for compound interest, $P = A(1+i)^{-n}$

4. Effective Rate of Interest

$$r_{eff} = \left[1 + \frac{r}{m}\right]^m - 1$$

5. Future Value of an Annuity

$$S = R\left[\frac{(1+i)^n - 1}{i}\right]$$ (S = future value of ordinary annuity of n payments of R dollars periodic payment)

6. Present Value of an Annuity

$$P = R\left[\frac{1-(1+i)^{-n}}{i}\right]$$ (P = present value of ordinary annuity of n payments of R dollars periodic payment)

7. Amortization Formula

$$R = \frac{Pi}{1-(1+i)^{-n}}$$ (R = periodic payment on a loan of P dollars to be amortized over n periods)

8. Sinking Fund Formula

$$R = \frac{Si}{(1+i)^n - 1}$$ (R = periodic payment required to accumulate S dollars over n periods)

9. Basic Rules of Differentiation

(a) Derivative of a constant: If $f(x)$ is a constant, then $f'(x)=0$

(b) Power rule : If $f(x)$ is x^n, then $f'(x)=nx^{n-1}$

(c) Constant multiple rule: $\frac{d}{dx}[cf(x)]=cf'(x)$ (c is a constant)

(d) Sum rule: $\frac{d}{dx}[f(x)\pm g(x)]=f'(x)\pm g'(x)$

(e) Product rule: If $f(x)=u(x)\cdot v(x)$, then $f'(x)=u(x)v'(x)+v(x)u'(x)$

(f) Quotient rule: $f'(x)=\frac{d}{dx}\left[\frac{u(x)}{v(x)}\right]=\frac{v(x)u'(x)-u(x)v'(x)}{[v(x)]^2}$

(g) Chain rule: $\frac{dy}{dx}=\frac{dy}{du}\times\frac{du}{dx}$

(h) General power rule: $\frac{d}{dx}[f(x)]^n=n[f(x)]^{n-1}f'(x)$

(i) Exponential function: $\frac{d}{dx}(e^u)=e^u[u'(x)]$

(j) Logarithmic function: $\frac{d}{dx}(\ln u)=\left(\frac{1}{u}\right)[u'(x)]$

10. Basic Rules of Integration

(a) Indefinite integral of a constant: $\int k\ du=ku+C$

(b) Power rule: $\int u^n du=\frac{u^{n+1}}{n+1}+C$

(c) Constant multiple rule: $\int kf(u)\ du=k\int f(u)\ du$ where k is a constant

(d) Sum rule: $\int[f(u)\pm g(u)]\ du=\int f(u)du+\int g(u)du$

(e) Exponential function: $\int e^u du=e^u+C$

(f) Logarithmic function: $\int\left(\frac{1}{u}\right)du=\ln u+C$

11. Determining Relative Extremas

$D(x,y)=f_{xx}f_{yy}-(f_{xy})^2$

If D > 0 and f_{xx} > 0, relative minimum point occurs at (x, y).
If D > 0 and f_{xx} < 0, relative maximum point occurs at (x, y).
If D < 0, (x, y) is neither maximum nor minimum.
If D = 0, the test is inconclusive.